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ISO/TC102/SC2/WG26B
IRON ORES - DETERMINATION OF MANGANESE CONTENT BY ATOMIC ABSORPTION SPECTROMETRIC METHOD

STATISTICAL ANALYSIS OF INTERNATIONAL TEST DATA - 1986

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October 1986

(For submission to the Convener of ISO/TC102/SC2/WG26B, to the Secretariat of ISO/TC102/SC2 and for presentation at the ISO/TC102/SC2 meeting to be held in Tokyo, Japan, 1986-11-10/14)

Project: 3 0 6 9.02
Analytical Methodology

This document is an unedited interim report prepared for submission to the Convener of ISO/TC102/SC2/WG26B, to the Secretariat of ISO/TC102/SC2 and for presentation at the ISO/TC102/SC2 meeting to be held in Tokyo, Japan, 1986-11-10/14. The opinions and conclusions contained herein are those of the author(s) and do not necessarily represent the official policy or position of the Canada Centre for Mineral and Energy Technology (CANMET)

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81 pp

MINERAL SCIENCES LABORATORIES
DIVISION REPORT MSL 86-130 (IR)

MICROMEDIA

ISO/TC102/SC2/WG26B(WG12 - 86/4)
October 1986

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SUMMARY

The analytical data resulting from the international test on the determination of manganese content in iron ores by atomic absorption spectrometric method conducted by ISO/TC102/SC2/WG26B during the period of 1984-1986 have been statistically evaluated. Based on these analytical results, the precision of the analytical method can be expresed in terms of the Mn concentration level by the following equations:

Acid attack dissolution	Fusion dissolution
$r = 0.0190\,X + 0.0040$	$r = 0.0168\,X + 0.0048$
$P = 0.0745\,X - 0.0075$	$P = 0.0318\,X + 0.0062$
$s_r = 0.0067\,X + 0.0014$	$s_r = 0.0059\,X + 0.0017$
$s_L = 0.0259\,X - 0.0032$	$s_L = 0.0104\,X + 0.0019$

where X is the Mn concentration in the sample, r is the repeatability, P is the permissible tolerance, s_r is the within-laboratory standard deviation and s_L is the between-laboratories standard deviation all expressed in percent. Five samples containing Mn ranging from 0.01 to 2.5% were used in this international test. Nineteen laboratories participated in this test.

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ISO/TC 102/SC2/WG26B(WG12 - 86/4)

MINERAIS DE FER - DOSAGE DE LA TENEUR EN MANGANÈSE PAR LA MÉTHODE DE SPECTROMÉTRIE D'ABSORPTION ATOMIQUE

par

R. Sutarno et W.S. Bowman

RÉSUMÉ

On a évalué statistiquement les résultats analytiques d'un essai international sur le dosage de la teneur en manganèse dans des minerais de fer par la méthode de spectrométrie d'absorption atomique, essai réalisé par le comité ISO/TC102/SC2/WG26B au cours de la période 1984-1986. En se basant sur ces résultats analytiques, on peut exprimer la précision de la méthode analytique en fonction des concentrations de Mn à l'aide des équations suivantes:

Dissolution par attaque à l'acide		Dissolution par fusion	
r	$= 0{,}0190\ X + 0{,}0040$	r	$= 0{,}0168\ X + 0{,}0048$
p	$= 0{,}0745\ X - 0{,}0075$	p	$= 0{,}0318\ X + 0{,}0062$
s_r	$= 0{,}0067\ X + 0{,}0014$	s_r	$= 0{,}0059\ X + 0{,}0017$
s_L	$= 0{,}0259\ X - 0{,}0032$	s_L	$= 0{,}0104\ X + 0{,}0019$

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où X est la concentration de Mn dans l'échantillon, r est la répétabilité, p est la tolérance admissible, s_r est l'écart-type intra-laboratoire et s_L est l'écart-type inter-laboratoire, tous exprimés en pourcentage. Dans cet essai international, on a utilisé cinq échantillons contenant du Mn dont les concentrations étaient comprises entre 0,01 à 2,5 %. Dix-neufs laboratoires ont participé à cet essai.

INTRODUCTION

This international test was conducted in accordance with Resolution 21 made at the twelfth meeting of ISO/TC102/SC2 held in Paris in 1984 (1).

The analytical data were collected by the convener of ISO/TC102/SC2/WG26B (ISO Technical Committee 102 - Iron Ores; Sub committee 2 - Chemical Analyses; Working Group 26B - Determination of manganese content in iron ores by atomic absorption spectrometric method) from an international test conducted during the period of 1984-1986. Two dissolution techniques, acid attack and fusion, were tested. Five samples with manganese contents ranging from 0.01 to 2.5% were used. Nineteen laboratories provided analytical data; each analysed two bottles of samples in duplicate.

The purpose of this statistical evaluation is to provide the working group with estimates of the precision in the form of repeatability, r, permissible tolerance, P, and within-laboratory, s_r, and between-laboratories, s_L, standard deviations.

PRINCIPLE OF THE ANALYTICAL METHOD(2)

Decomposition of the test portion:

(a). By treatment with hydrochloric acid with addition of a small ammount of nitric acid. Evaporation to dehydrate silica, addition of hydrochloric acid, dilution and fitration. Ignition of the residue and removal of silica by evaporation with hydrofluoric and sulfuric acids. Fusion with sodium

carbonate and sodium tetraborate and dissolution of the cooled melt in the filtrate.

(b). By fusion of the test portion in sodium carbonate/sodium tetraborate flux and dissolution of the crude melt in hydrochloric acid.

Aspiration of the solution obtained in either case into the flame of the atomic absorption spectrometer using a dinitrogen oxide/acetylene flame. Comparison of the absorbance value obtained with those from the calibration solution.

STATISTICAL EVALUATION

The analytical data were statistically evaluated by the procedure described in document ISO/TC102/TCR5 (3). This procedure is illustrated schematically in Figure 1.

The raw data and the detailed calculation are presented in Appendix A. They are summarized in Tables 1 and 2. The raw data are also plotted in Figures 2. The boxed points in these figures signify that the data were suspected to be outliers and were excluded from the estimation of the sample means and precisions. The letter C on the boxed points signifies that the data were suspected to be outliers due to poor precision (Cochran's test) and the letter D signifies the deviation from the sample means (Dixon's test).

The precisions estimated (s_r, s_L, r and P) are plotted against their corresponding sample means in Figures 3, and the regression equations of these precisions against sample means were computed and presented in Tables 1. Tables 2 list the suspected outliers.

OBSERVATIONS

An ideal standard analytical method is an analytical method that can be applied by any qualified analyst with proper equipment and reagents with equal precision and accuracy. This implies that the better the method is standardized the smaller is the s_L/s_r ratio and the fewer the number of outliers. The magnitude of within-laboratory standard deviation itself depends on the state of the art of the method. Experience has shown that for a good method, the average s_L/s_r ratio is found to be about 2. Table 1 shows that the magnitude of the within-laboratory precision seems to be reasonable. Using s_L/s_r ratio of 2 as a bench mark, the observed s_L/s_r ratios for both techniques are acceptable; with the exception of the results from sample 83-8 for acid attack dissolution, where the s_L/s_r ratio is 3.71. Figure 2.a.5 shows large between-laboratories variation of the results for this sample. Some chemical explanation should be sought for this large variation. It may be related to the high manganese content of this sample. Tables 2 show that the number of outliers is rather high, with the acid attack dissolution being the worse of the two. Some laboratories reported outliers more than once. Laboratory CA 2 seemed to have some difficulty with the acid attack dissolution technique.

Table 3 shows that there is no significant difference between the accuracy of the results from the two dissolution techniques. Table 4 shows that, with the exception of sample 83-8 (high Mn content), there is insignificant difference in their precision.

Tables 5 and 6 show that these results are very similar to those obtained from the previous international test (4).

REFERENCES

1. "Final report of the twelfth meeting of ISO/TC102/SC2 : Iron ores/Chemical Analysis, held in Paris, October 16-18, 1984", ISO/TC102/SC2 N792, 1985-03-12.

2. "Iron ores - Determination of manganese content - Flame atomic absorption spectrometric method", Second working draft, ISO/TC102/SC2 (WG26B-1), March 1986.

3. "Procedure for statistical evaluation of analytical data resulting from international tests",ISO/TC102/TCR5,1985-06-11.

4. "Iron ores - Determination of manganese content by flame atomic absorption spectrometry - Statistical evaluation of international test data - 1984", R. Sutarno and W.S. Bowman, MRP/MSL 85-41 (IR), March 1985.

Table 1. a.

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION

SUMMARY OF PRECISIONS FOR ALL SAMPLES

ELEMENT	SAMPLE	KO	K	NO	N	MEAN(X)	REPEATABILITY	PERMISSIBLE TOLERANCE	SIGMA-R	SIGMA-L	SIGMA-L/SIGMA-R
MANGANESE	76-16	17	15	67	59	.0110	.0014	.0029	.00050	.00098	1.94
MANGANESE	83-7	17	15	66	58	.0863	.0037	.0077	.00130	.00257	1.98
MANGANESE	83-4	17	14	67	55	.4029	.0089	.0143	.00315	.00454	1.44
MANGANESE	76-12	17	16	68	64	.7689	.0287	.0337	.01014	.00952	.94
MANGANESE	83-8	17	14	68	56	2.5291	.0494	.1867	.01747	.06482	3.71

THE REGRESSION EQUATIONS ARE:

					CORR. COEFF.
R	=	.0190 X	+	.0040	.9610
P	=	.0745 X	+	-.0075	.9890
SIGMA-R	=	.0067 X	+	.0014	.9609
SIGMA-L	=	.0259 X	+	-.0032	.9842

Table 1. f.

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION

SUMMARY OF PRECISIONS FOR ALL SAMPLES

ELEMENT	SAMPLE	KO	K	NO	N	MEAN(X)	REPEATABILITY	PERMISSIBLE TOLERANCE	SIGMA-R	SIGMA-L	SIGMA-L/SIGMA-R
MANGANESE	76-16	19	19	76	76	.0113	.0019	.0032	.00067	.00103	1.53
MANGANESE	83-7	19	18	76	72	.0874	.0041	.0064	.00143	.00202	1.41
MANGANESE	83-4	19	17	76	68	.4024	.0115	.0182	.00407	.00576	1.42
MANGANESE	76-12	19	19	76	76	.7722	.0253	.0402	.00894	.01271	1.42
MANGANESE	83-8	19	15	76	60	2.5232	.0451	.0839	.01592	.02743	1.72

THE REGRESSION EQUATIONS ARE:

					CORR. COEFF.
R	=	.0168 X	+	.0048	.9700
P	=	.0318 X	+	.0062	.9871
SIGMA-R	=	.0059 X	+	.0017	.9700
SIGMA-L	=	.0104 X	+	.0019	.9895

Table 2. a.

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION

LIST OF OUTLIERS

ELEMENT	SAMPLE	COCHRAN (PRECISION)	DIXON (ACCURACY)	LAB HAS ONLY ONE RESULT	INDIVIDUAL OUTLYING RESULT (DIXON)
MANGANESE	76-16	SU 1	CA 2	-	-
MANGANESE	83-7	SE 1	CA 2	-	-
MANGANESE	83-4	SU 2	CA 1	-	-
		-	CA 2	-	-
		-	SU 2	-	-
MANGANESE	76-12	-	CA 2	-	-
MANGANESE	83-8	AU 2	-	-	-
		AU 3	-	-	-
		FR 1	-	-	-

Table 2. f.

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION

LIST OF OUTLIERS

ELEMENT	SAMPLE	COCHRAN (PRECISION)	DIXON (ACCURACY)	LAB HAS ONLY ONE RESULT	INDIVIDUAL OUTLYING RESULT (DIXON)
MANGANESE	76-16	-	-	-	-
MANGANESE	83-7	-	FR 1	-	-
MANGANESE	83-4	FR 1	-	-	-
		SU 3	-	-	-
MANGANESE	76-12	-	-	-	-
MANGANESE	83-8	AU 4	-	-	-
		FR 1	-	-	-
		SE 1	-	-	-
		SU 3	-	-	-

Table 3
ISO/TC102/SC2/WG26B
IRON ORES - DETERMINATION OF MANGANESE CONTENT
BY ATOMIC ABSORPTION SPECTROMETRIC METHOD
Comparison between the means obtained by acid attack and fusion dissolution techniques.

Sample No	Mean (X%)			$V(X).10^4$		$S_d.10^2$	T	*
	Acid X_1	Fusion X_2	$X_2 - X_1$	Acid $V(X_1)$	Fusion $V(X_2)$			
76-16	0.0110	0.0113	0.0003	0.00068	0.00062	0.0361	0.83	I
83-7	0.0863	0.0874	0.0011	0.00478	0.00255	0.0856	1.28	I
83-4	0.4029	0.4024	-0.0005	0.01657	0.02198	0.1963	0.25	I
76-12	0.7689	0.7722	0.0033	0.07689	0.09552	0.4152	0.80	I
83-8	2.5291	2.5232	-0.0059	3.05563	0.54402	1.8973	0.31	I

X_1 - Grand mean of results obtained by acid attack dissolution technique

X_2 - Grand mean of results obtained by fusion dissolution technique

$V(X)$ - Variance of the grand means

$S_d = \sqrt{[V(X_1) + V(X_2)]}$

$T = |X_2 - X_1|/S_d$

I = The difference between the two dissolution techniques is statistically insignificant

S = The difference between the two dissolution techniques is statistically significant

Table 4

ISO/TC102/SC2/WG26B

IRON ORES - DETERMINATION OF MANGANESE CONTENT BY ATOMIC ABSORPTION SPECTROMETRIC METHOD

Comparison between precision of results obtained by acid attack and fusion dissolution techniques.

Sample No	Within-laboratory precision 10^4						Between-laboratories precision 10^2					
	Acid		Fusion		Pc	*	Acid		Fusion		Pc	*
	$s_{r_1}^2$	f_{r_1}	$s_{r_2}^2$	f_{r_2}			MS_1	fMS_1	MS_2	fMS_2		
76-16	0.00254	44	0.00455	57	1.79	I	0.00040	14	0.00047	18	1.17	I
83-7	0.01697	43	0.02051	54	1.21	I	0.00273	14	0.00184	17	0.67	I
83-4	0.09943	41	0.16578	51	1.67	I	0.00908	13	0.01494	16	1.65	I
76-12	1.02729	48	0.79947	57	0.78	I	0.04655	15	0.07260	18	1.56	I
83-8	3.05214	42	2.53561	45	0.83	I	1.71116	13	0.32641	14	0.19	S

s_r - Within - laboratory standard deviation

f_r - Degrees of freedom associated with s_r

MS - Between- laboratories mean squares

fMS - Degrees of freedom associated with MS

$Pc_r = s_{r_2}^2 / s_{r_1}^2$

$PcMS = MS_2 / MS_1$

I = The difference between the two dissolution techniques is statistically insignificant

S = The difference between the two dissolution techniques is statistically significant

Table 5
ISO/TC102/SC2/WG26B
IRON ORES - DETERMINATION OF MANGANESE CONTENT
BY ATOMIC ABSORPTION SPECTROMETRIC METHOD
Comparison between the means of results obtained by the present international test with that of the previous test.

Sample No	Grand means (X%)					
	1984 X_3	Acid X_1	Fusion X_2	X_3/X_3	X_1/X_3	X_2/X_3
76-16	0.0114	0.0110	0.0113	1.00	0.96	0.99
83-7	0.0870	0.0863	0.0874	1.00	0.99	1.00
76-12	0.7739	0.7689	0.7722	1.00	0.99	1.00
83-8	2.5295	2.5291	2.5232	1.00	1.00	1.00

Table 6
ISO/TC102/SC2/WG26B
IRON ORES - DETERMINATION OF MANGANESE CONTENT
BY ATOMIC ABSORPTION SPECTROMETRIC METHOD
Comparison between the precision of results obtained by the present international test with that of the previous test.

Sample	Repeatability, r			Permissible tolerance, P		
No	1984 r_3	Acid r_1	Fusion r_2	1984 P_3	Acid P_1	Fusion P_2
76-16	0.0018	0.0014	0.0019	0.0036	0.0029	0.0032
Rel*	1.00	0.78	1.06	1.00	0.81	0.89
83-7	0.0051	0.0037	0.0041	0.0102	0.0077	0.0064
Rel	1.00	0.73	0.80	1.00	0.75	0.63
76-12	0.0236	0.0287	0.0253	0.0338	0.0337	0.0402
Rel	1.00	1.22	1.07	1.00	1.00	1.19
83-8	0.0469	0.0494	0.0451	0.1243	0.1867	0.0839
Rel	1.00	1.05	0.96	1.00	1.50	0.67

*Rel - Ratio between the present results to that of the previous test.

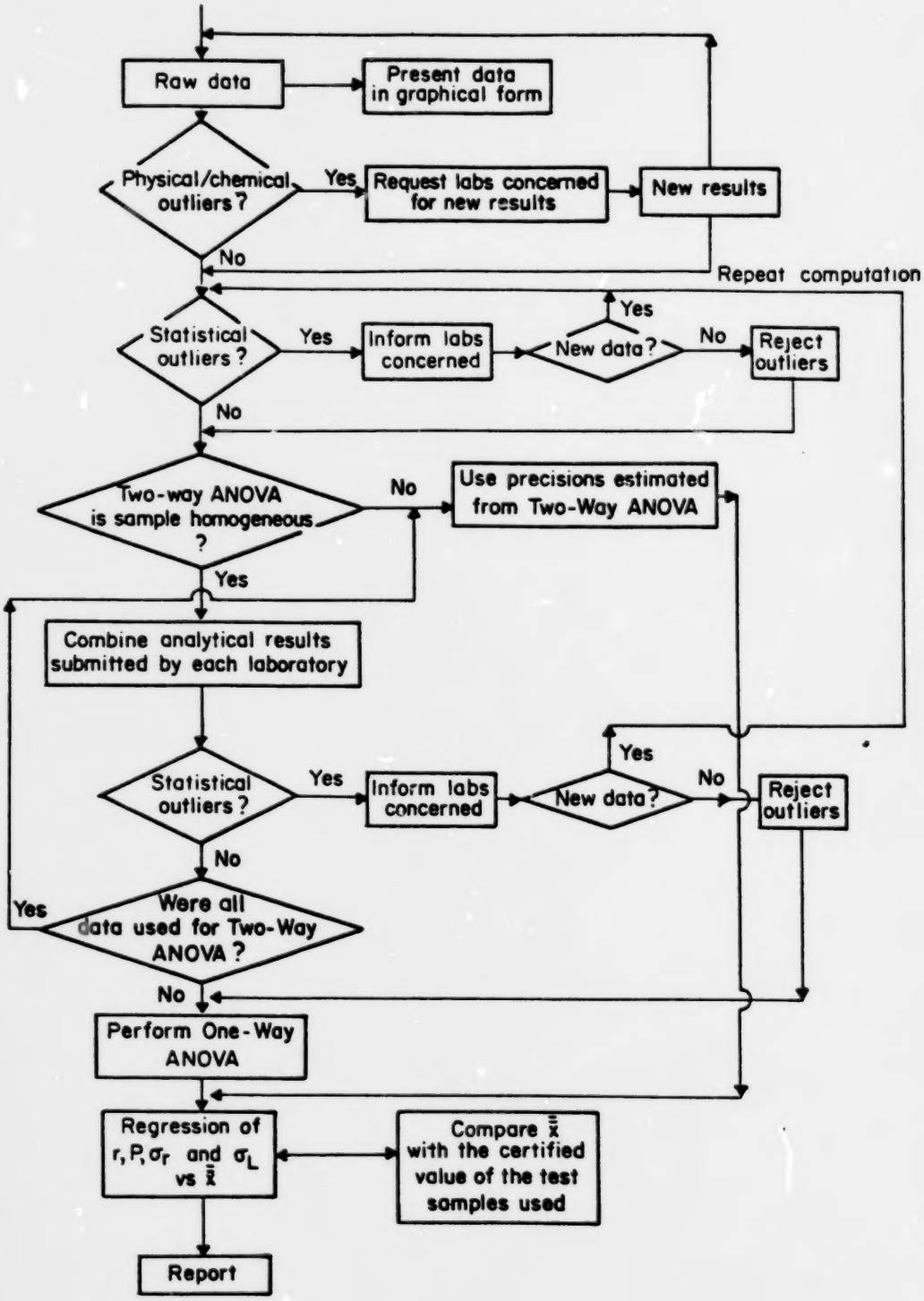

Figure 1. Flow chart of the Procedure for Statistical Evaluation of Analytical Data Resulting from International Tests.

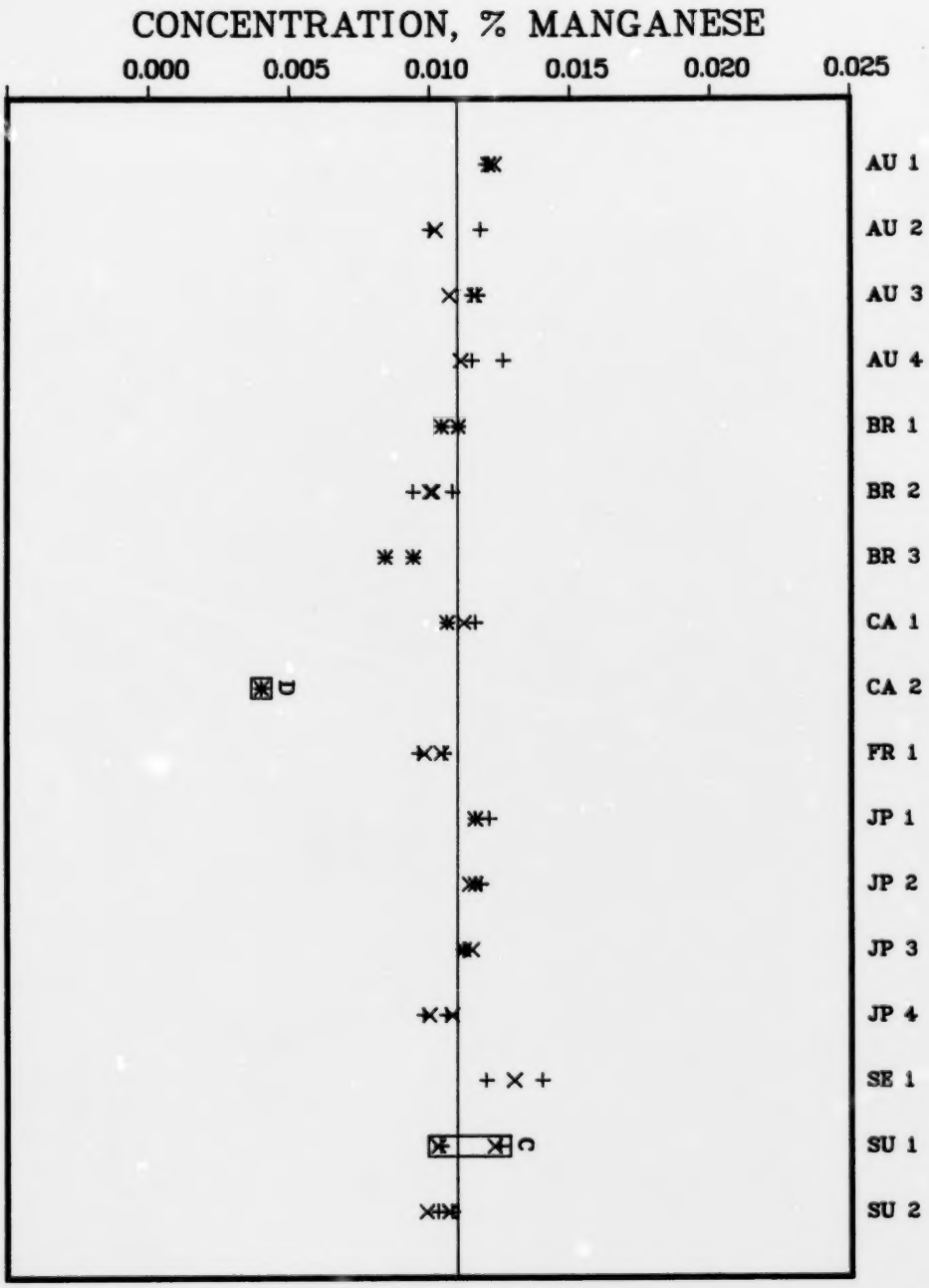

Figure 2. a. 1

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION

SAMPLE: 76-16

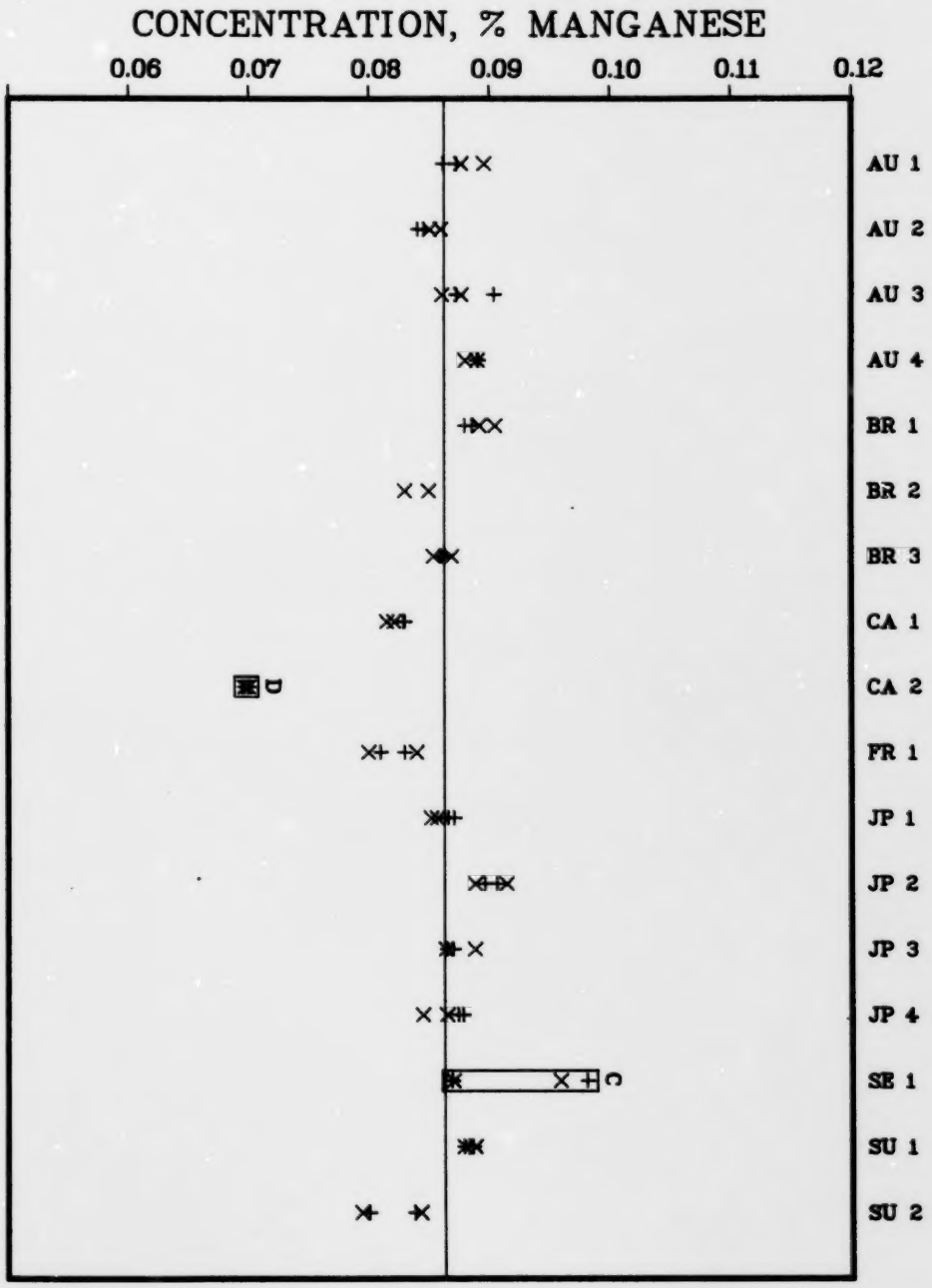

Figure 2. a. 2

ISO/TC 102/SC 2/WG 26B – MANGANESE BY AAS METHOD – ACID ATTACK DISSOLUTION

SAMPLE: 83–7

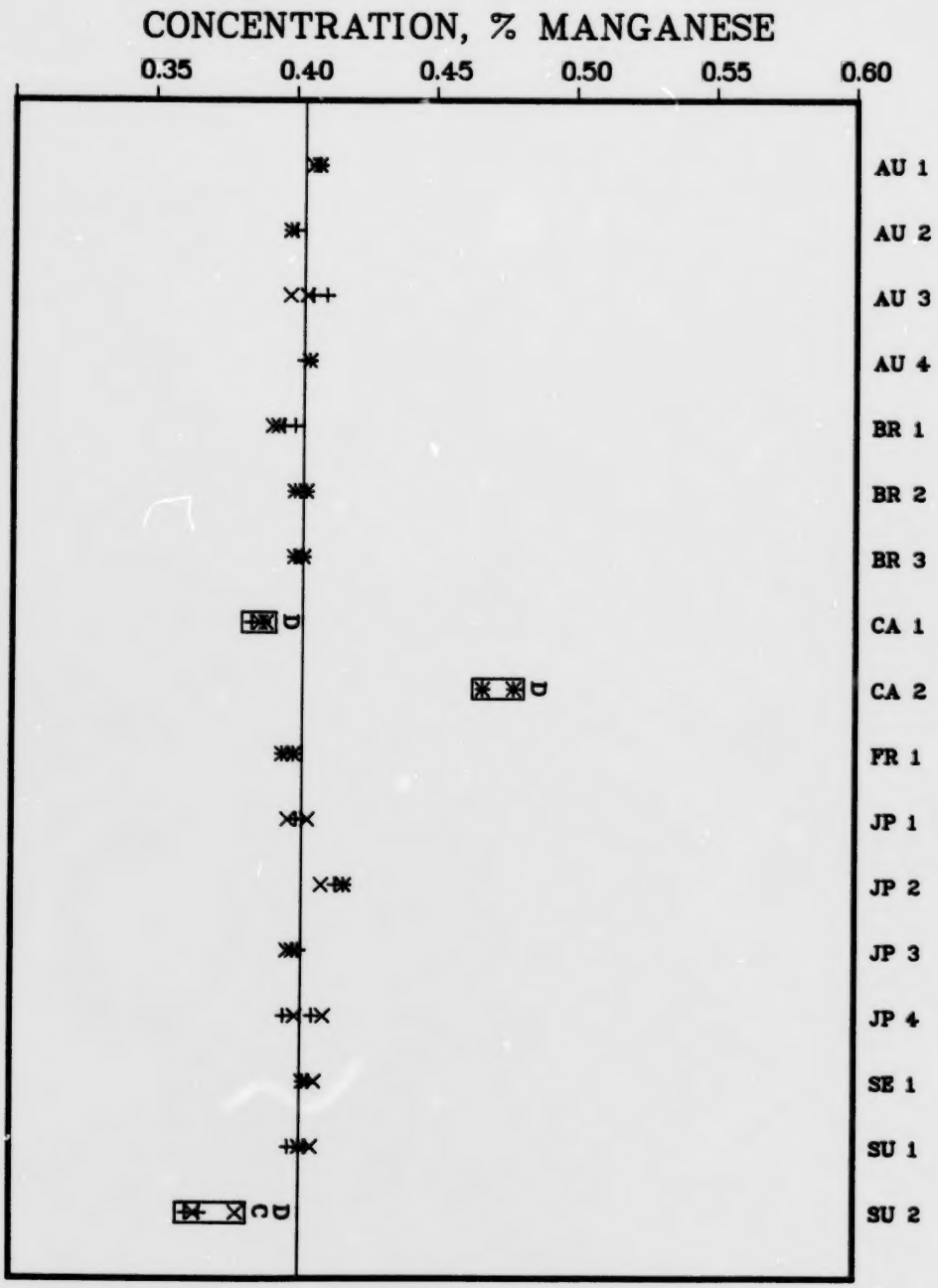

Figure 2. a. 3

ISO/TC 102/SC 2/WG 28B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION

SAMPLE: 83-4

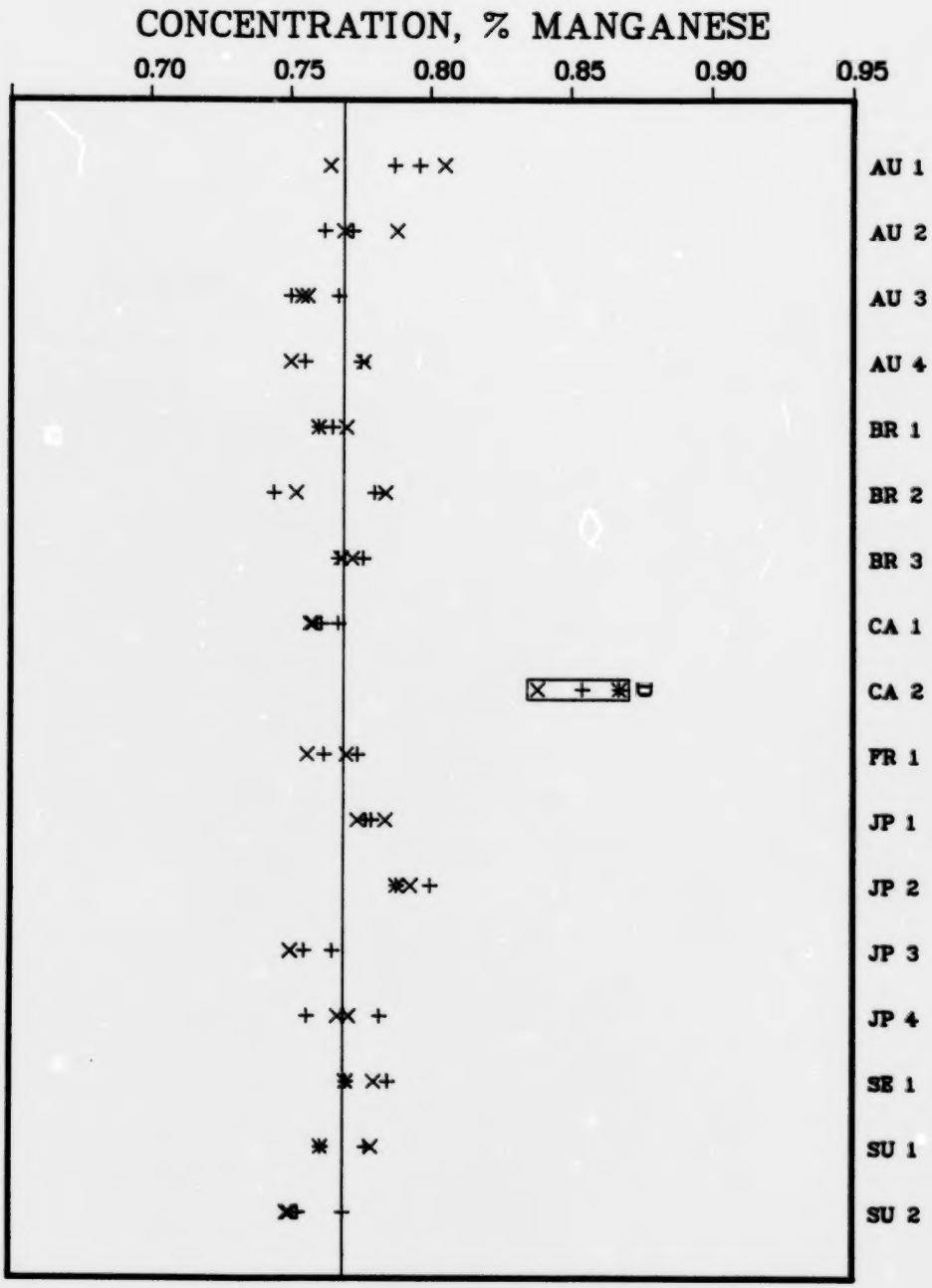

Figure 2. a. 4

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION

SAMPLE: 76-12

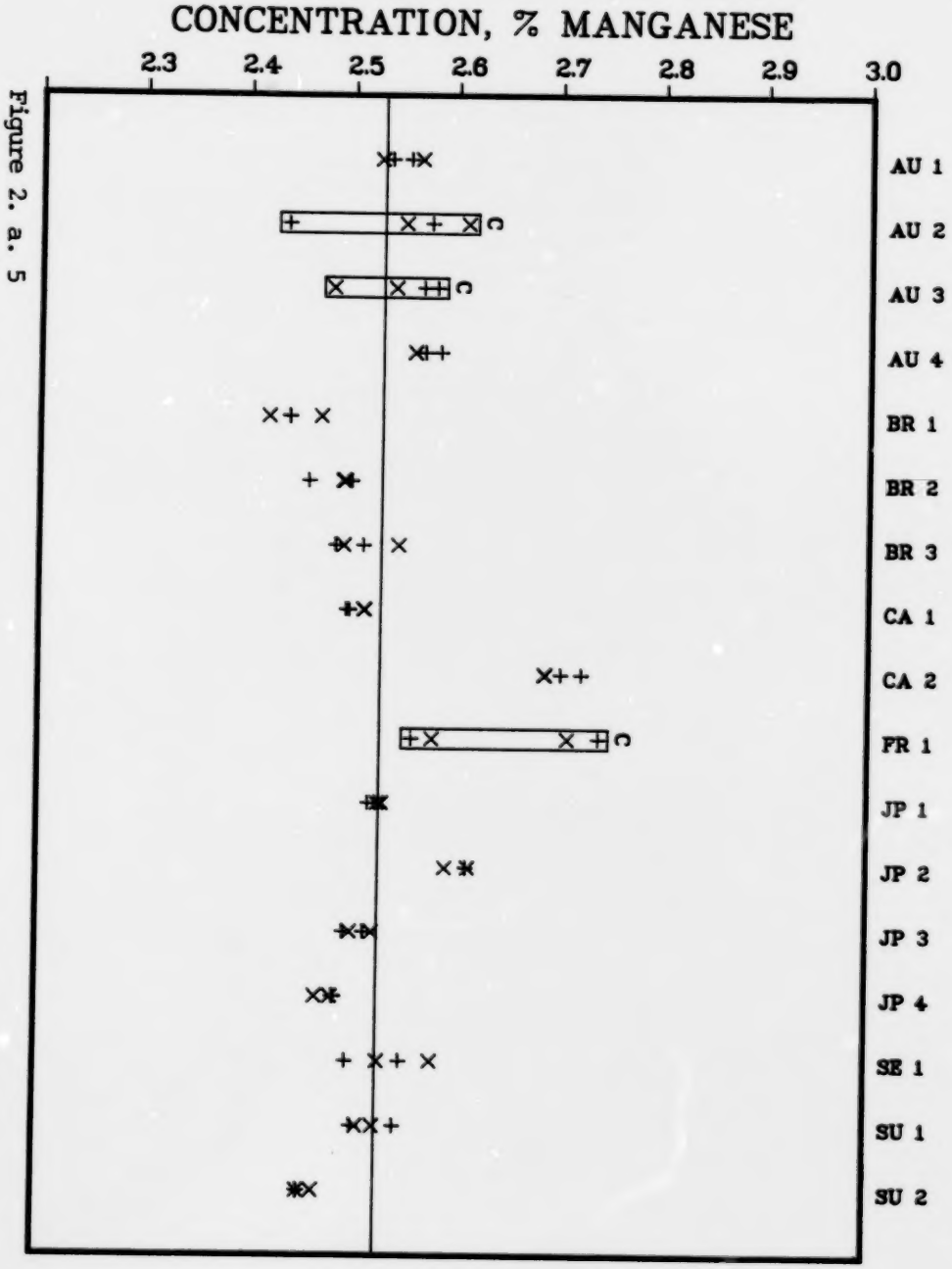

Figure 2. a. 5

ISO/TC 102/SC 2/WG 28B – MANGANESE BY AAS METHOD – ACID ATTACK DISSOLUTION
SAMPLE: 83–8

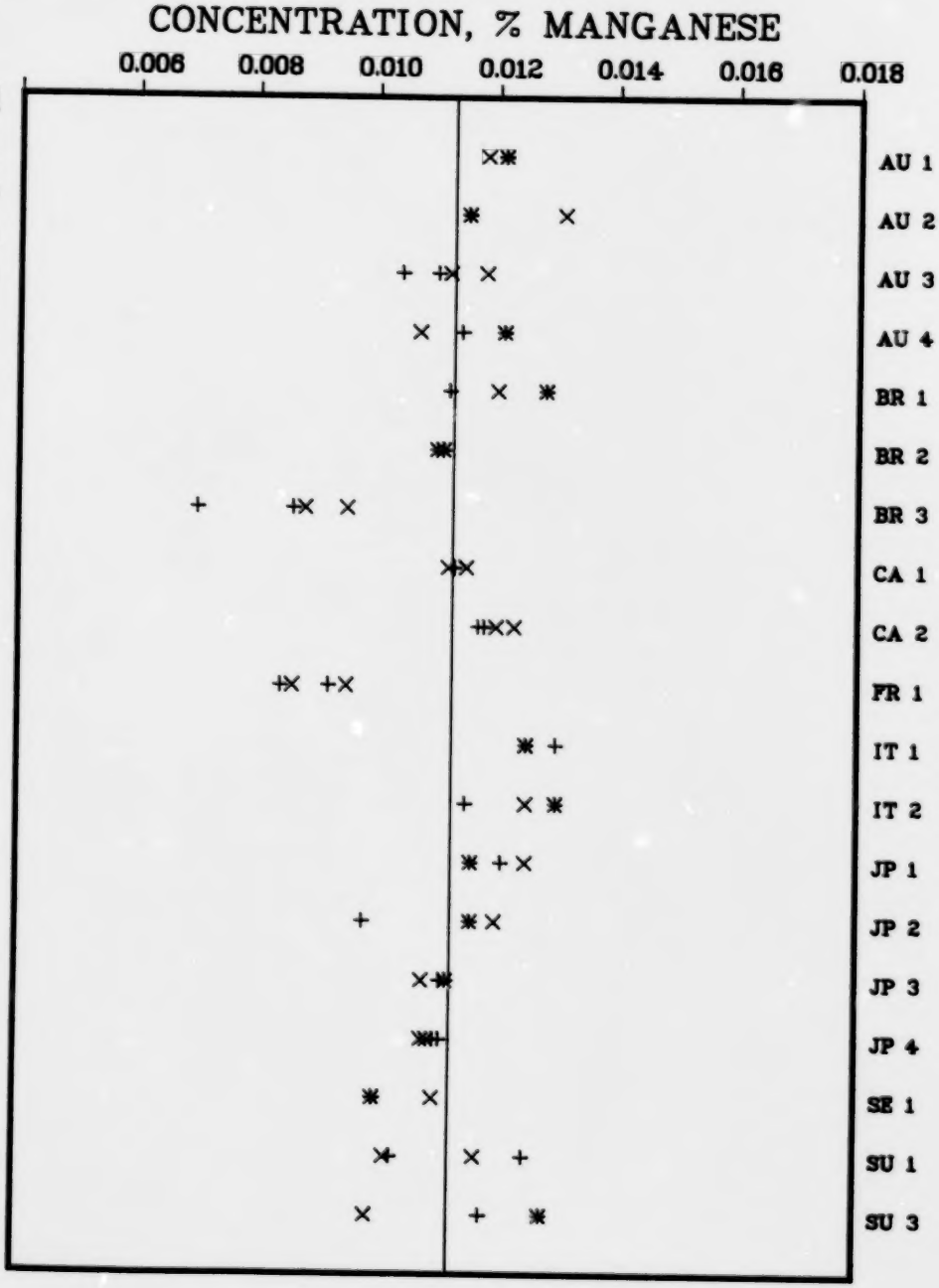

Figure 2. f. 1

ISO/TC 102/SC 2/WG 28B – MANGANESE BY AAS METHOD – FUSION DISSOLUTION

SAMPLE 76-16

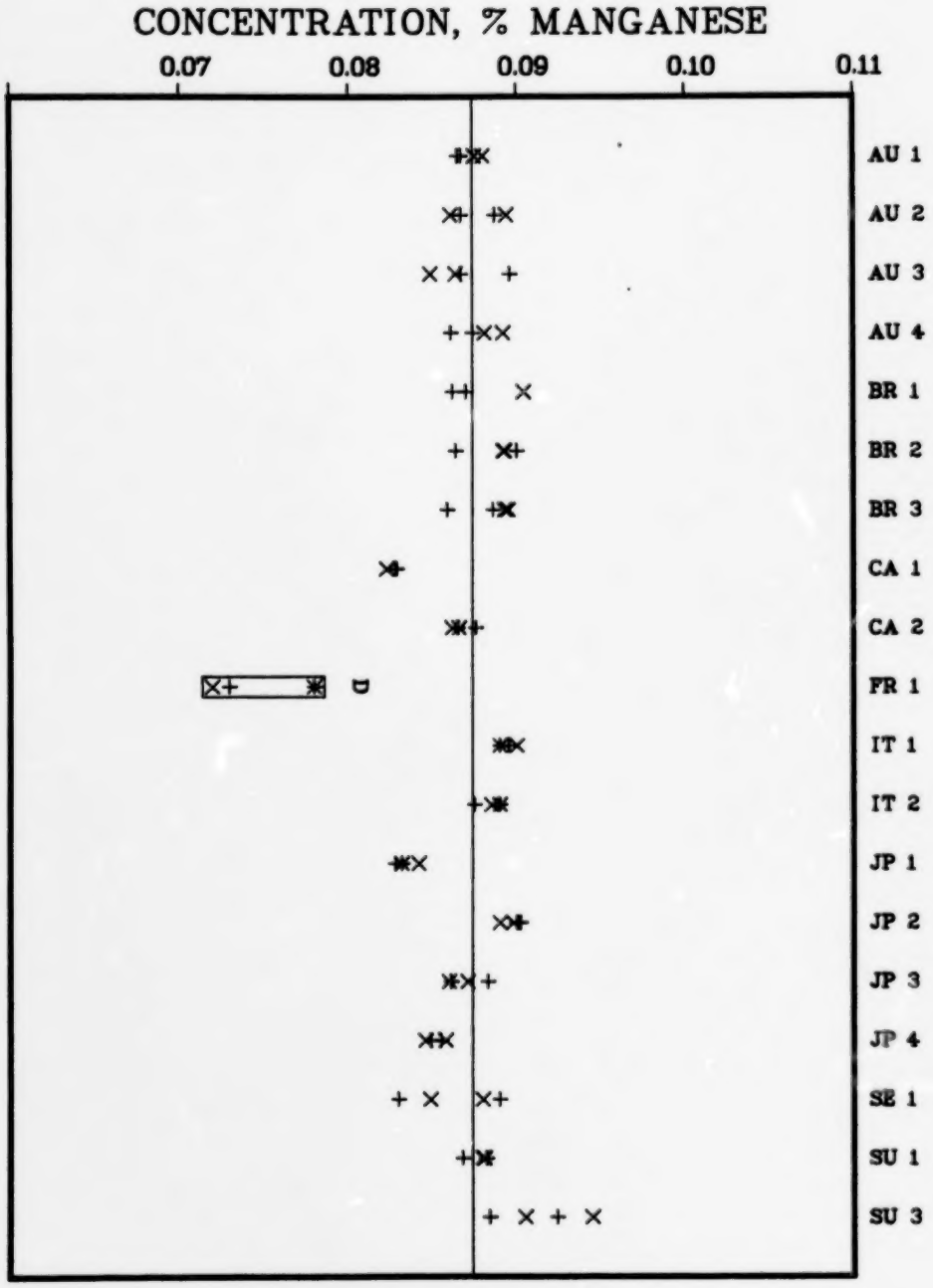

Figure 2. f. 2

ISO/TC 102/SC 2/WG 26B – MANGANESE BY AAS METHOD – FUSION DISSOLUTION

SAMPLE 83-7

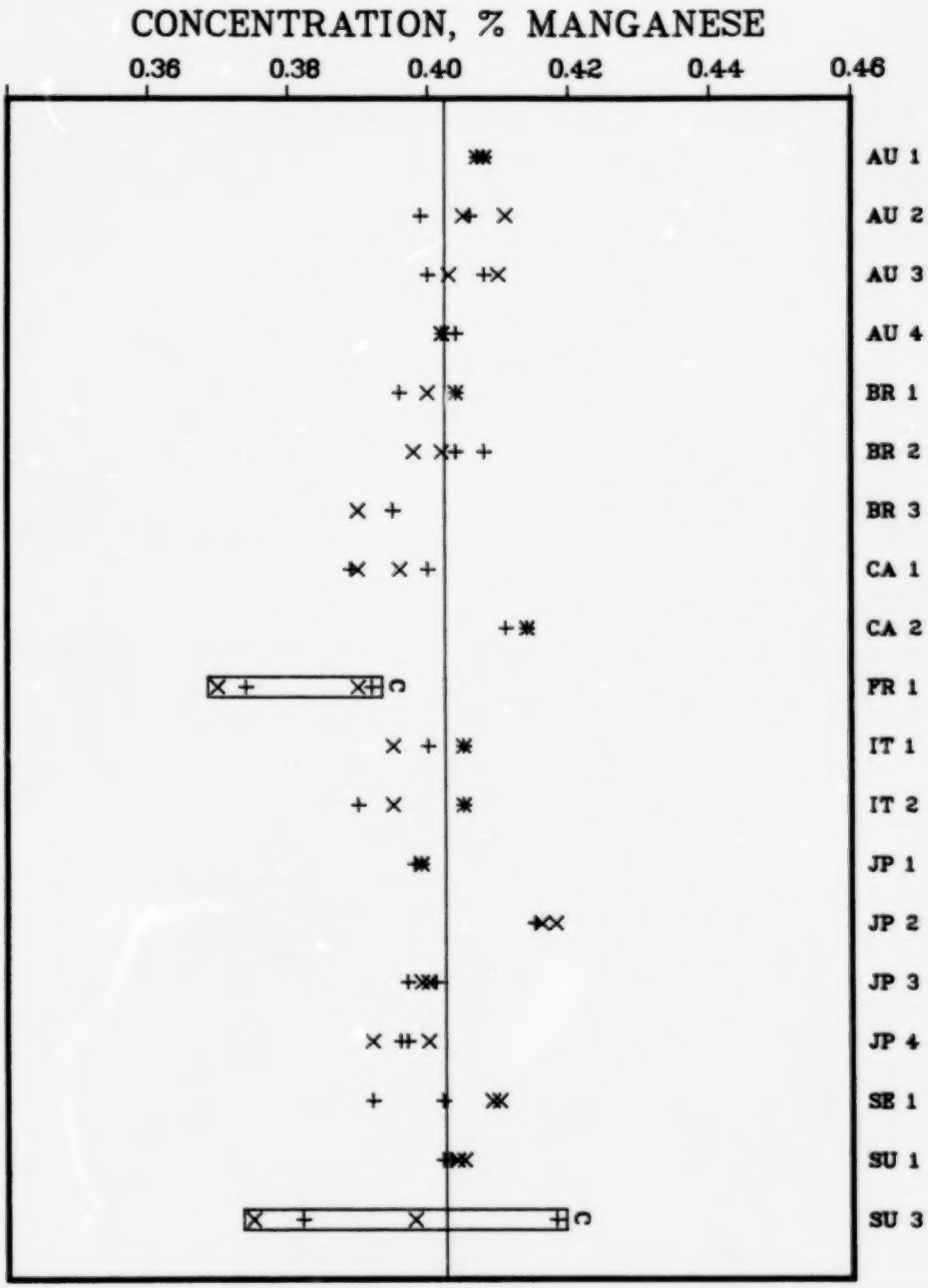

Figure 2. f. 3

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION

SAMPLE: 83-4

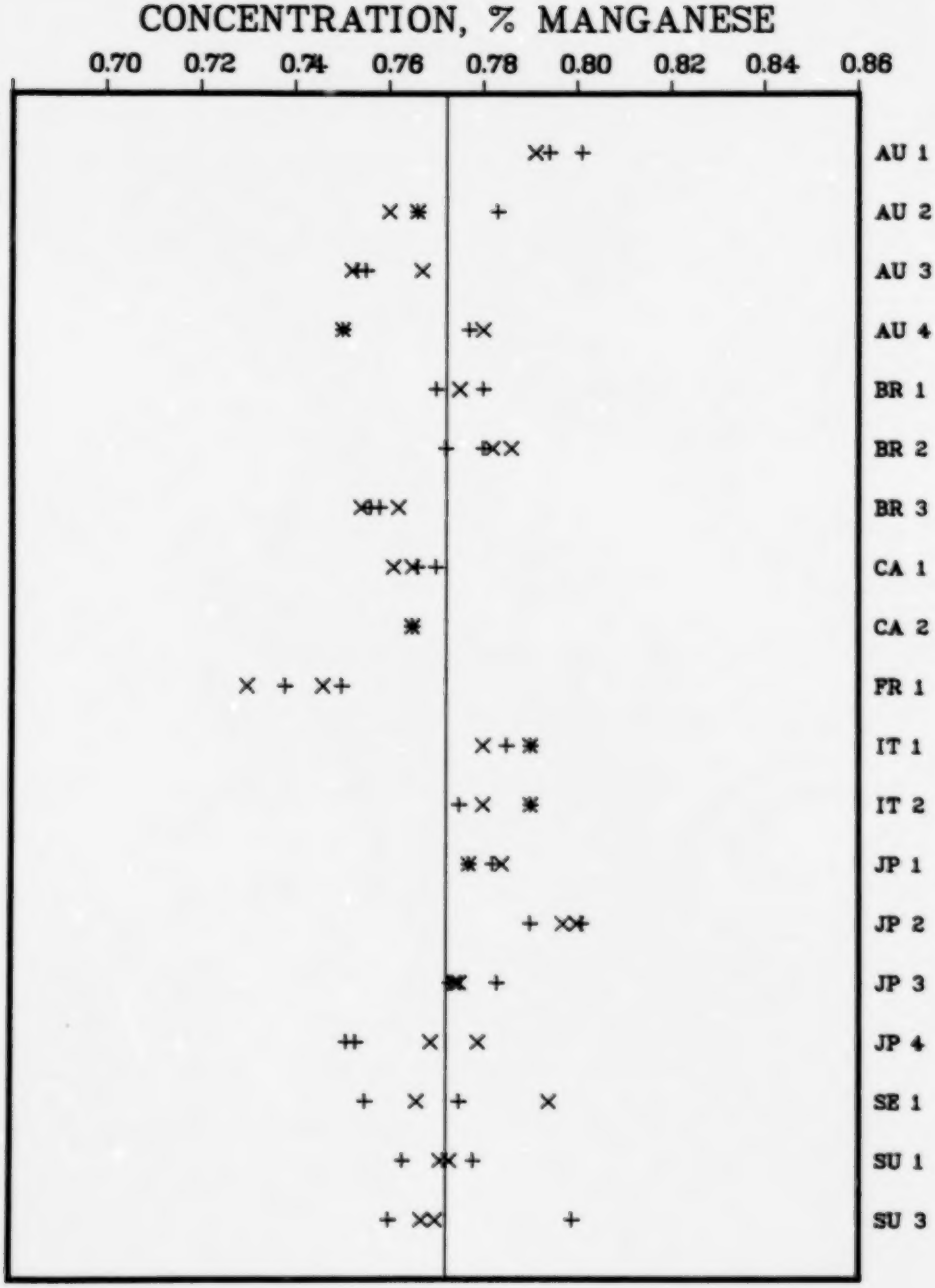

Figure 2. f. 4

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION

SAMPLE 76-12

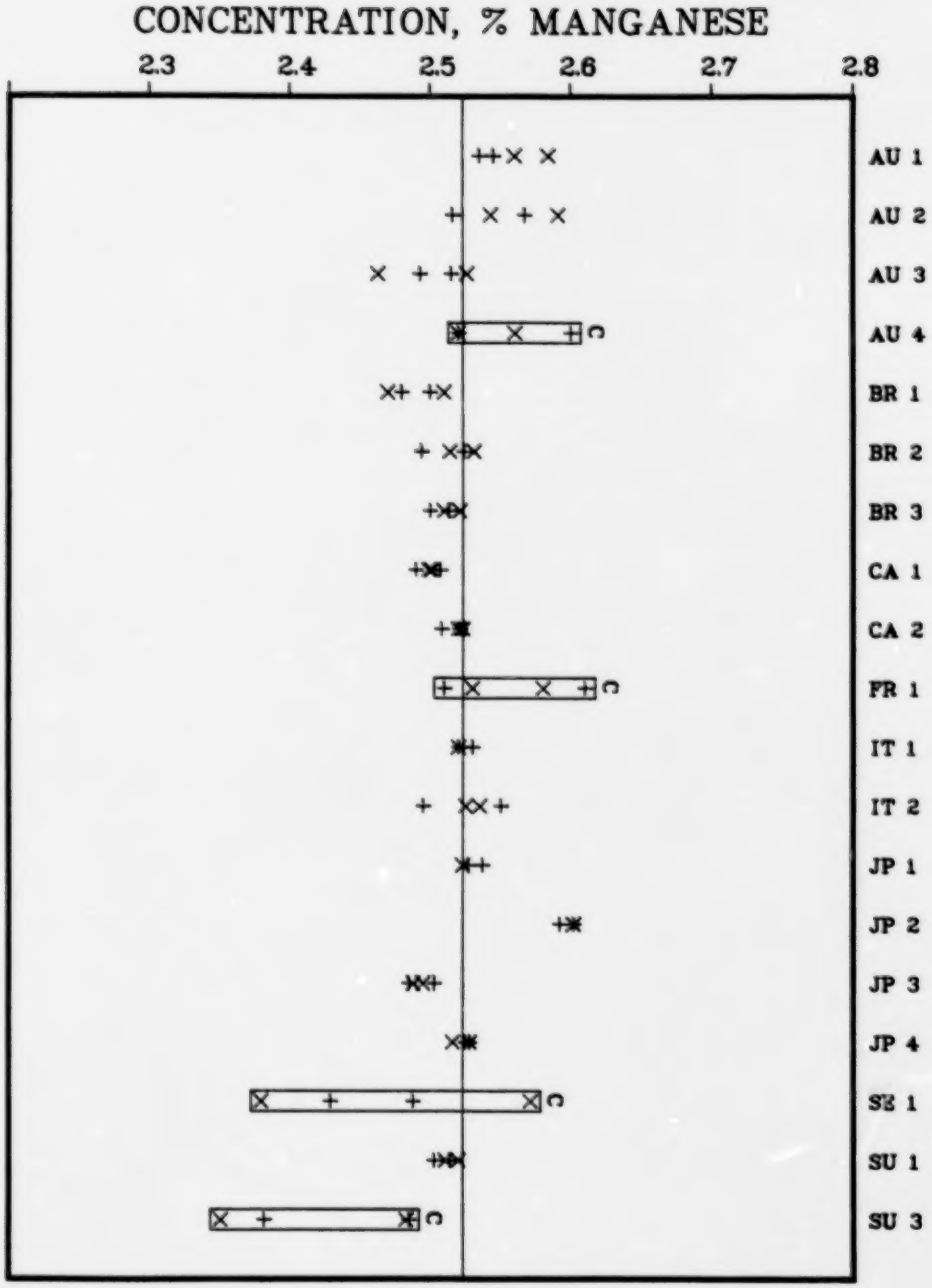

Figure 2. f. 5

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION

SAMPLE: 83-8

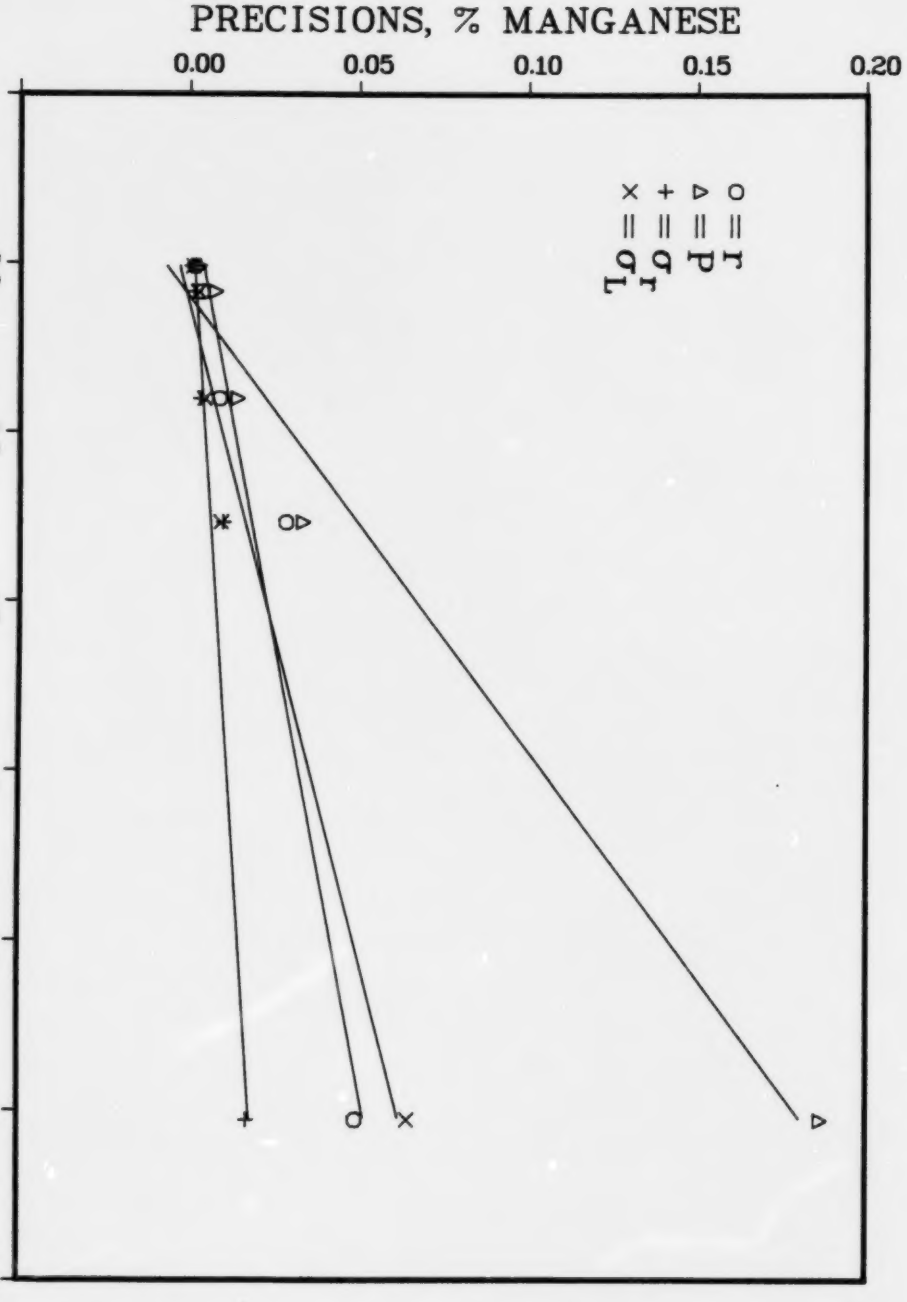

Figure 3. a

ISO/TC 102/SC 2/WG 26B – MANGANESE BY AAS METHOD – ACID ATTACK DISSOLUTION

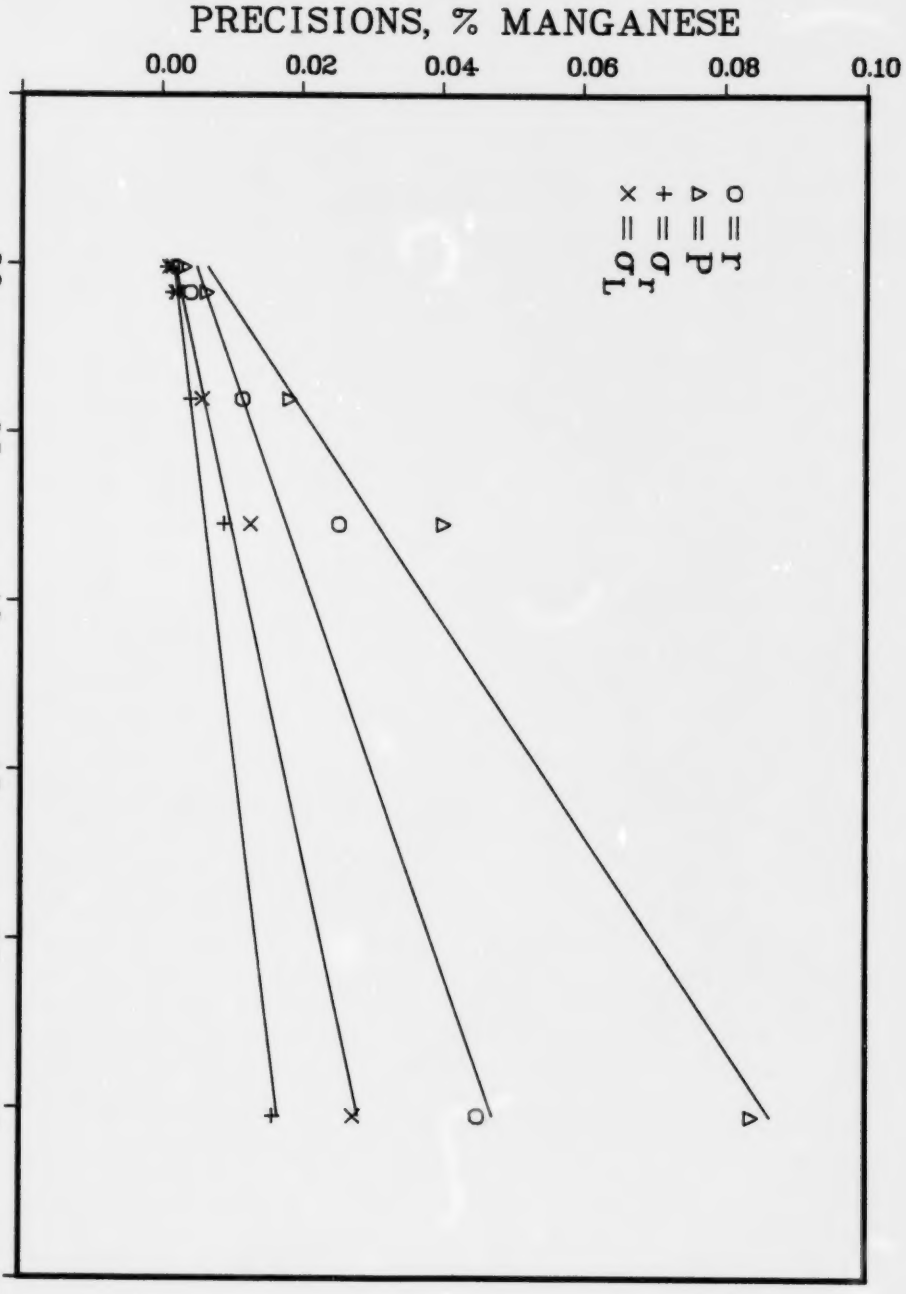

Figure 3. f

ISO/TC 102/SC 2/WG 26B – MANGANESE BY AAS METHOD – FUSION DISSOLUTION

Abbreviations Used in this Report

s_r = SIGMA-R - within laboratory standard deviation

s_L = SIGMA-L - between laboratories standard deviation

r* = R - repeatability

$= 2.83\, s_r$

p** = permissible tolerance between laboratories

$= 2.83\left(s_L^2 + s_r^2/2\right)^{\frac{1}{2}}$

* Repeatability, r, is the value below which the absolute difference between two independent single test (analysis) results produced by a laboratory on identical material using the same equipment within a short interval of time, using the standardized test method, may be expected to be with a 95% probability.

** Permissible tolerance between laboratories, P, is the value below which the absolute difference between two means of duplicate test results on identical material obtained by operators of different laboratories using the standardized test method, may be expected to lie with a 95% probability.

KO - total number of participating laboratories

K - number of sets of laboratory results used for ANOVA

NO - total number of analytical results

N - No. of analytical results used for ANOVA

ISO/TC102/SC2/WG26B
IRON ORES - DETERMINATION OF MANGANESE CONTENT
BY ATOMIC ABSORPTION SPECTROMETRIC METHOD

STATISTICAL ANALYSIS OF INTERNATIONAL TEST DATA - 1986

Appendix A. Acid

Detailed Computation of the Analytical Data

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-16

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.0121	.0123	.01213	.1583E-07
		2	.0120	.0121		
2	AU 2	1	.0102	.0102	.01055	.7033E-06
		2	.0100	.0118		
3	AU 3	1	.0116	.0107	.01138	.2092E-06
		2	.0117	.0115		
4	AU 4	1	.0111		.01173	.6033E-06
		2	.0115	.0126		
5	BR 1	1	.0104	.0110	.01070	.1200E-06
		2	.0110	.0104		
6	BR 2	1	.0101	.0100	.01008	.3292E-06
		2	.0094	.0108		
7	BR 3	1	.0084	.0094	.00890	.3333E-06
		2	.0084	.0094		
8	CA 1	1	.0112	.0106	.01100	.2400E-06
		2	.0106	.0116		
9	CA 2	1	.0040	.0040	.00400	.0000E+00
		2	.0040	.0040		
10	FR 1	1	.0104	.0098	.01008	.1958E-06
		2	.0105	.0096		
11	JP 1	1	.0116	.0116	.01173	.6250E-07
		2	.0121	.0116		
12	JP 2	1	.0116	.0114	.01160	.2667E-07
		2	.0118	.0116		
13	JP 3	1	.0115	.0112	.01128	.2250E-07
		2	.0112	.0112		
14	JP 4	1	.0100	.0108	.01030	.2267E-06
		2	.0098	.0106		
15	SE 1	1	.0130	.0130	.01300	.6667E-06
		2	.0120	.0140		
16	SU 1	1	.0123	.0103	.01138	.1409E-05
		2	.0125	.0104		
17	SU 2	1	.0107	.0099	.01043	.1692E-06
		2	.0108	.0103		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-16

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	16.533
CHI-SQUARE(.95,21)	32.678

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

CA 2	BOTTLE- 1	T-CALC = 4.199	T-CRIT(.00156,30) = 3.479
CA 2	BOTTLE- 2	T-CALC = 6.980	T-CRIT(.00161,29) = 3.479

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

AU 2	ZERO WITHIN-BOTTLE VARIANCE
AU 4	NUMBER OF BOTTLES OR REPLICATES INCORRECT
CA 2	DOORNBOS' TEST FOR BOTTLE MEANS
JP 1	ZERO WITHIN-BOTTLE VARIANCE
JP 3	ZERO WITHIN-BOTTLE VARIANCE
SE 1	ZERO WITHIN-BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-16

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	10	.32372273E-04	.32372273E-05
BETWEEN BOTTLES	11	.43500000E-06	.39545455E-07
WITHIN BOTTLES	22	.93900000E-05	.42681818E-06
TOTAL	43	.42197273E-04	

F-CALC = .093 F-CRIT(.95;11,22) = 2.259

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-16

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	26.256
CHI-SQUARE(.95,15)	25.000

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

SU 1 C-CALC = .264 C-CRIT(4,16) = .262

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

CA 2 R = .786 D-CRIT(17) = .529

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

CA 2	DIXON'S TEST FOR LABORATORY MEANS
SU 1	COCHRAN'S TEST FOR LABORATORY VARIANCE

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-16

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	14	.55992189E-04	.39994421E-05
WITHIN LABS	44	.11169167E-04	.25384470E-06
TOTAL	58	.67161356E-04	

REPEATABILITY VARIANCE	.25384470E-06
REPEATABILITY STD. DEV.	.00050383
BETWEEN-LABORATORIES VARIANCE	.95254416E-06
BETWEEN-LABORATORIES STD. DEV.	.00097598
REPEATABILITY	.00142584
PERMISSIBLE TOLERANCE BETWEEN LABS	.00294030
GRAND MEAN	.01097797
VARIANCE OF THE GRAND MEAN	.68060795E-07

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-7

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.0896	.0877	.08770	.2007E-05
		2	.0873	.0862		
2	AU 2	1	.0860	.0851	.08495	.6567E-06
		2	.0846	.0841		
3	AU 3	1	.0877	.0861	.08788	.3296E-05
		2	.0873	.0904		
4	AU 4	1	.0880	.0890	.08878	.2692E-06
		2	.0891	.0890		
5	BR 1	1	.0892	.0905	.08908	.1142E-05
		2	.0880	.0886		
6	BR 2	1	.0850	.0830	.08400	.2000E-05
7	BR 3	1	.0854	.0869	.08613	.3825E-06
		2	.0862	.0860		
8	CA 1	1	.0821	.0815	.08238	.5025E-06
		2	.0830	.0829		
9	CA 2	1	.0700	.0697	.06985	.3000E-07
		2	.0700	.0697		
10	FR 1	1	.0840	.0800	.08200	.3333E-05
		2	.0830	.0810		
11	JP 1	1	.0852	.0857	.08615	.7367E-06
		2	.0871	.0866		
12	JP 2	1	.0914	.0888	.09010	.1293E-05
		2	.0906	.0896		
13	JP 3	1	.0888	.0864	.08718	.1242E-05
		2	.0870	.0865		
14	JP 4	1	.0845	.0865	.08655	.2163E-05
		2	.0878	.0874		
15	SE 1	1	.0870	.0959	.09198	.3448E-04
		2	.0869	.0981		
16	SU 1	1	.0879	.0888	.08830	.2200E-06
		2	.0879	.0886		
17	SU 2	1	.0843	.0794	.08188	.6409E-05
		2	.0838	.0800		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-7

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	51.990
CHI-SQUARE(.95,31)	44.991

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR BOTTLE VARIANCE (ALPHA=.05)

SE 1	BOTTLE- 2	C-CALC = .409	C-CRIT(2,32) = .279
SE 1	BOTTLE- 1	C-CALC = .437	C-CRIT(2,31) = .286

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

CA 2	BOTTLE- 1	T-CALC = 3.823	T-CRIT(.00156,30) = 3.479
CA 2	BOTTLE- 2	T-CALC = 5.600	T-CRIT(.00161,29) = 3.479

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

BR 2	NUMBER OF BOTTLES OR REPLICATES INCORRECT
CA 2	DOORNBOS' TEST FOR BOTTLE MEANS
SE 1	COCHRAN'S TEST FOR BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-7

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	13	.37135304E-03	.28565618E-04
BETWEEN BOTTLES	14	.19987500E-04	.14276786E-05
WITHIN BOTTLES	28	.50975000E-04	.18205357E-05
TOTAL	55	.44231554E-03	

F-CALC = .784 F-CRIT(.95;14,28) = 2.064

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-7

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	51.797
CHI-SQUARE(.95,16)	26.301

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

SE 1 C-CALC = .573 C-CRIT(4,17) = .250

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

CA 2 R = .632 D-CRIT(17) = .529

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

CA 2	DIXON'S TEST FOR LABORATORY MEANS
SE 1	COCHRAN'S TEST FOR LABORATORY VARIANCE

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-7

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	14	.38209836E-03	.27292740E-04
WITHIN LABS	43	.72962500E-04	.16968023E-05
TOTAL	57	.45506086E-03	

REPEATABILITY VARIANCE	.16968023E-05
REPEATABILITY STD. DEV.	.00130261
BETWEEN-LABORATORIES VARIANCE	.66275196E-05
BETWEEN-LABORATORIES STD. DEV.	.00257440
REPEATABILITY	.00368640
PERMISSIBLE TOLERANCE BETWEEN LABS	.00773782
GRAND MEAN	.08627759
VARIANCE OF THE GRAND MEAN	.47844501E-06

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-4

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.4060	.4080	.40725	.9167E-06
		2	.4080	.4070		
2	AU 2	1	.3980	.3980	.39850	.1000E-05
		2	.3980	.4000		
3	AU 3	1	.3980	.4040	.40475	.2892E-04
		2	.4110	.4060		
4	AU 4	1	.4050		.40433	.1333E-05
		2	.4050	.4030		
5	BR 1	1	.3940	.3920	.39550	.1167E-04
		2	.3960	.4000		
6	BR 2	1	.4000	.4040	.40200	.5333E-05
		2	.4000	.4040		
7	BR 3	1	.4000	.4030	.40150	.3000E-05
		2	.4000	.4030		
8	CA 1	1	.3880	.3900	.38800	.4667E-05
		2	.3850	.3890		
9	CA 2	1	.4780	.4670	.47250	.4033E-04
		2	.4780	.4670		
10	FR 1	1	.4000	.3960	.39800	.5333E-05
		2	.4000	.3960		
11	JP 1	1	.3980	.4050	.40175	.8917E-05
		2	.4030	.4010		
12	JP 2	1	.4180	.4100	.41525	.1425E-04
		2	.4180	.4150		
13	JP 3	1	.4000	.3980	.40000	.2667E-05
		2	.4000	.4020		
14	JP 4	1	.4110	.4010	.40400	.3867E-04
		2	.4070	.3970		
15	SE 1	1	.4040	.4080	.40550	.3667E-05
		2	.4040	.4060		
16	SU 1	1	.4070	.4030	.40300	.1067E-04
		2	.4030	.3990		
17	SU 2	1	.3810	.3660	.36950	.6300E-04
		2	.3680	.3630		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-4

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	17.535
CHI-SQUARE(.95,29)	42.565

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

CA 2	BOTTLE- 1	T-CALC = 4.204	T-CRIT(.00156,30) = 3.479
CA 2	BOTTLE- 2	T-CALC = 7.002	T-CRIT(.00161,29) = 3.479
SU 2	BOTTLE- 2	T-CALC = 4.290	T-CRIT(.00167,28) = 3.479
SU 2	BOTTLE- 1	T-CALC = 4.433	T-CRIT(.00172,27) = 3.479

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

AU 2	ZERO WITHIN-BOTTLE VARIANCE
AU 4	NUMBER OF BOTTLES OR REPLICATES INCORRECT
CA 2	DOORNBOS' TEST FOR BOTTLE MEANS
SU 2	DOORNBOS' TEST FOR BOTTLE MEANS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-4

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	12	.19459231E-02	.16216026E-03
BETWEEN BOTTLES	13	.12900000E-03	.99230769E-05
WITHIN BOTTLES	26	.28700000E-03	.11038462E-04
TOTAL	51	.23619231E-02	

F-CALC = .899 F-CRIT(.95;13,26) = 2.119

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-4

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	31.633
CHI-SQUARE(.95,16)	26.301

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

SU 2 C-CALC = .258 C-CRIT(4,17) = .250

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

SU 2	R =	.689	D-CRIT(17) =	.529
CA 2	R =	.876	D-CRIT(16) =	.546
CA 1	R =	.571	D-CRIT(15) =	.565

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

CA 1	DIXON'S TEST FOR LABORATORY MEANS
CA 2	DIXON'S TEST FOR LABORATORY MEANS
SU 2	DIXON'S TEST FOR MEANS AND COCHRAN'S TEST FOR VARIANCE

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-4

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	13	.11800424E-02	.90772494E-04
WITHIN LABS	41	.40766667E-03	.99430894E-05
TOTAL	54	.15877091E-02	

REPEATABILITY VARIANCE	.99430894E-05
REPEATABILITY STD. DEV.	.00315327
BETWEEN-LABORATORIES VARIANCE	.20581561E-04
BETWEEN-LABORATORIES STD. DEV.	.00453669
REPEATABILITY	.00892374
PERMISSIBLE TOLERANCE BETWEEN LABS	.01430567
GRAND MEAN	.40292727
VARIANCE OF THE GRAND MEAN	.16572128E-05

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-12

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.8050	.7640	.78800	.3100E-03
		2	.7960	.7870		
2	AU 2	1	.7880	.7690	.77275	.1209E-03
		2	.7720	.7620		
3	AU 3	1	.7560	.7540	.75675	.5292E-04
		2	.7500	.7670		
4	AU 4	1	.7760	.7500	.76400	.1807E-03
		2	.7750	.7550		
5	BR 1	1	.7600	.7700	.76375	.2292E-04
		2	.7650	.7600		
6	BR 2	1	.7520	.7840	.76500	.3987E-03
		2	.7440	.7800		
7	BR 3	1	.7680	.7720	.77075	.1692E-04
		2	.7760	.7670		
8	CA 1	1	.7580	.7570	.76075	.2025E-04
		2	.7670	.7610		
9	CA 2	1	.8670	.8380	.85650	.1897E-03
		2	.8670	.8540		
10	FR 1	1	.7700	.7560	.76550	.6500E-04
		2	.7740	.7620		
11	JP 1	1	.7740	.7840	.77850	.1767E-04
		2	.7790	.7770		
12	JP 2	1	.7880	.7930	.79225	.3225E-04
		2	.8000	.7880		
13	JP 3	1	.7500	.7500	.75500	.5000E-04
		2	.7650	.7550		
14	JP 4	1	.7710	.7670	.76900	.1153E-03
		2	.7820	.7560		
15	SE 1	1	.7700	.7800	.77625	.5625E-04
		2	.7850	.7700		
16	SU 1	1	.7790	.7610	.76950	.9700E-04
		2	.7770	.7610		
17	SU 2	1	.7500	.7490	.75525	.8692E-04
		2	.7690	.7530		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-12

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	26.536
CHI-SQUARE(.95,31)	44.991

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

CA 2	BOTTLE- 2	T-CALC = 4.832	T-CRIT(.00147,32) = 3.480
CA 2	BOTTLE- 1	T-CALC = 7.459	T-CRIT(.00152,31) = 3.479

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

CA 2	DOORNBOS' TEST FOR BOTTLE MEANS
JP 3	ZERO WITHIN-BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-12

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	14	.61539333E-02	.43956667E-03
BETWEEN BOTTLES	15	.46200000E-03	.30800000E-04
WITHIN BOTTLES	30	.43190000E-02	.14396667E-03
TOTAL	59	.10934933E-01	

F-CALC = .214 F-CRIT(.95;15,30) = 2.015

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-12

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	19.927
CHI-SQUARE(.95,16)	26.301

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

CA 2 R = .687 D-CRIT(17) = .529

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

CA 2 DIXON'S TEST FOR LABORATORY MEANS

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 76-12

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	15	.69827500E-02	.46551667E-03
WITHIN LABS	48	.49310000E-02	.10272917E-03
TOTAL	63	.11913750E-01	

REPEATABILITY VARIANCE	.10272917E-03
REPEATABILITY STD. DEV.	.01013554
BETWEEN-LABORATORIES VARIANCE	.90696875E-04
BETWEEN-LABORATORIES STD. DEV.	.00952349
REPEATABILITY	.02868358
PERMISSIBLE TOLERANCE BETWEEN LABS	.03373064
GRAND MEAN	.76893750
VARIANCE OF THE GRAND MEAN	.72736979E-05

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-8

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	2.5650	2.5260	2.54525	.3076E-03
		2	2.5360	2.5540		
2	AU 2	1	2.6100	2.5500	2.54300	.5599E-02
		2	2.5750	2.4370		
3	AU 3	1	2.4810	2.5410	2.54275	.1972E-02
		2	2.5810	2.5680		
4	AU 4	1	2.5600	2.5600	2.56875	.1396E-03
		2	2.5700	2.5850		
5	BR 1	1	2.4700	2.4200	2.44250	.4250E-03
		2	2.4400	2.4400		
6	BR 2	1	2.4920	2.4940	2.48625	.3416E-03
		2	2.4590	2.5000		
7	BR 3	1	2.4930	2.5460	2.50900	.7367E-03
		2	2.4850	2.5120		
8	CA 1	1	2.5130	2.5140	2.50550	.8700E-04
		2	2.4990	2.4960		
9	CA 2	1	2.6880	2.6870	2.70025	.2836E-03
		2	2.7230	2.7030		
10	FR 1	1	2.7100	2.5800	2.64750	.8225E-02
		2	2.7400	2.5600		
11	JP 1	1	2.5280	2.5320	2.52625	.2958E-04
		2	2.5190	2.5260		
12	JP 2	1	2.6160	2.5940	2.60950	.1077E-03
		2	2.6140	2.6140		
13	JP 3	1	2.5240	2.5030	2.50975	.1589E-03
		2	2.5160	2.4960		
14	JP 4	1	2.4850	2.4700	2.48250	.7100E-04
		2	2.4880	2.4870		
15	SE 1	1	2.5310	2.5820	2.54125	.1194E-02
		2	2.5000	2.5520		
16	SU 1	1	2.5110	2.5270	2.52275	.3416E-03
		2	2.5470	2.5060		
17	SU 2	1	2.4550	2.4690	2.45850	.4900E-04
		2	2.4550	2.4550		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-8

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	47.030
CHI-SQUARE(.95,25)	37.660

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR BOTTLE VARIANCE (ALPHA=.05)

FR 1 BOTTLE- 2 C-CALC = .354 C-CRIT(2,26) = .325

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

AU 4	ZERO WITHIN-BOTTLE VARIANCE
BR 1	ZERO WITHIN-BOTTLE VARIANCE
FR 1	COCHRAN'S TEST FOR BOTTLE VARIANCE
JP 2	ZERO WITHIN-BOTTLE VARIANCE
SU 2	ZERO WITHIN-BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-8

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	11	.14046592E+00	.12769629E-01
BETWEEN BOTTLES	12	.12237000E-01	.10197500E-02
WITHIN BOTTLES	24	.21133000E-01	.88054167E-03
TOTAL	47	.17383592E+00	

F-CALC = 1.158 F-CRIT(.95;12,24) = 2.183

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-8

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	57.831
CHI-SQUARE(.95,16)	26.301

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

FR 1	C-CALC = .410	C-CRIT(4,17) = .250
AU 2	C-CALC = .473	C-CRIT(4,16) = .262
AU 3	C-CALC = .316	C-CRIT(4,15) = .276

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

AU 2	COCHRAN'S TEST FOR LABORATORY VARIANCE
AU 3	COCHRAN'S TEST FOR LABORATORY VARIANCE
FR 1	COCHRAN'S TEST FOR LABORATORY VARIANCE

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - ACID ATTACK DISSOLUTION
SAMPLE: 83-8

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	13	.22244986E+00	.17111527E-01
WITHIN LABS	42	.12819000E-01	.30521429E-03
TOTAL	55	.23526886E+00	

REPEATABILITY VARIANCE	.30521429E-03
REPEATABILITY STD. DEV.	.01747038
BETWEEN-LABORATORIES VARIANCE	.42015783E-02
BETWEEN-LABORATORIES STD. DEV.	.06481958
REPEATABILITY	.04944118
PERMISSIBLE TOLERANCE BETWEEN LABS	.18674109
GRAND MEAN	2.52914286
VARIANCE OF THE GRAND MEAN	.30556299E-03

ISO/TC102/SC2/WG26B
IRON ORES - DETERMINATION OF MANGANESE CONTENT
BY ATOMIC ABSORPTION SPECTROMETRIC METHOD

STATISTICAL ANALYSIS OF INTERNATIONAL TEST DATA - 1986

Appendix A. Fusion

Detailed Computation of the Analytical Data

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-16

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.0118	.0121	.01203	.2250E-07
		2	.0121	.0121		
2	AU 2	1	.0131	.0115	.01190	.6400E-06
		2	.0115	.0115		
3	AU 3	1	.0118	.0112	.01110	.3333E-06
		2	.0110	.0104		
4	AU 4	1	.0107	.0121	.01158	.4492E-06
		2	.0114	.0121		
5	BR 1	1	.0120	.0128	.01220	.5867E-06
		2	.0112	.0128		
6	BR 2	1	.0111	.0110	.01105	.3333E-08
		2	.0110	.0111		
7	BR 3	1	.0088	.0095	.00848	.1116E-05
		2	.0070	.0086		
8	CA 1	1	.0115	.0112	.01133	.1583E-07
		2	.0113	.0113		
9	CA 2	1	.0123	.0120	.01195	.7000E-07
		2	.0117	.0118		
10	FR 1	1	.0095	.0086	.00893	.2625E-06
		2	.0092	.0084		
11	IT 1	1	.0125	.0125	.01263	.6250E-07
		2	.0130	.0125		
12	IT 2	1	.0125	.0130	.01250	.5000E-06
		2	.0115	.0130		
13	JP 1	1	.0125	.0116	.01195	.1900E-06
		2	.0121	.0116		
14	JP 2	1	.0116	.0120	.01125	.9700E-06
		2	.0098	.0116		
15	JP 3	1	.0108	.0112	.01108	.3583E-07
		2	.0112	.0111		
16	JP 4	1	.0109	.0108	.01095	.1667E-07
		2	.0111	.0110		
17	SE 1	1	.0100	.0110	.01025	.2500E-06
		2	.0100	.0100		
18	SU 1	1	.0117	.0102	.01118	.1249E-05
		2	.0125	.0103		
19	SU 3	1	.0099	.0128	.01183	.1869E-05
		2	.0118	.0128		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-16

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	28.369
CHI-SQUARE(.95,27)	40.119

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

BR 3 BOTTLE- 2 T-CALC = 3.666 T-CRIT(.00132,36) = 3.484

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

AU 1	ZERO WITHIN-BOTTLE VARIANCE
AU 2	ZERO WITHIN-BOTTLE VARIANCE
BR 3	DOORNBOS' TEST FOR BOTTLE MEANS
CA 1	ZERO WITHIN-BOTTLE VARIANCE
IT 1	ZERO WITHIN-BOTTLE VARIANCE
SE 1	ZERO WITHIN-BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-16

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	12	.37402308E-04	.31168590E-05
BETWEEN BOTTLES	13	.38125000E-05	.29326923E-06
WITHIN BOTTLES	26	.15795000E-04	.60750000E-06
TOTAL	51	.57009808E-04	

F-CALC = .483 F-CRIT(.95;13,26) = 2.119

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-16

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	49.851
CHI-SQUARE(.95,18)	28.877

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

NONE REJECTED

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

ALL RESULTS WERE USED EXCEPT INDIVIDUAL REPLICATES LISTED BELOW

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-16

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	18	.84352895E-04	.46862719E-05
WITHIN LABS	57	.25927500E-04	.45486842E-06
TOTAL	75	.11028039E-03	

REPEATABILITY VARIANCE	.45486842E-06
REPEATABILITY STD. DEV.	.00067444
BETWEEN-LABORATORIES VARIANCE	.10578509E-05
BETWEEN-LABORATORIES STD. DEV.	.00102852
REPEATABILITY	.00190866
PERMISSIBLE TOLERANCE BETWEEN LABS	.00320838
GRAND MEAN	.01126974
VARIANCE OF THE GRAND MEAN	.61661473E-07

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-7

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.0880	.0875	.08718	.4892E-06
		2	.0865	.0867		
2	AU 2	1	.0894	.0861	.08773	.2482E-05
		2	.0887	.0867		
3	AU 3	1	.0864	.0849	.08690	.3860E-05
		2	.0867	.0896		
4	AU 4	1	.0881	.0892	.08770	.1687E-05
		2	.0861	.0874		
5	BR 1	1	.0904	.0904	.08850	.4920E-05
		2	.0862	.0870		
6	BR 2	1	.0892	.0893	.08873	.2529E-05
		2	.0900	.0864		
7	BR 3	1	.0893	.0895	.08833	.2763E-05
		2	.0859	.0886		
8	CA 1	1	.0823	.0823	.08258	.1025E-06
		2	.0828	.0829		
9	CA 2	1	.0862	.0866	.08673	.3692E-06
		2	.0865	.0876		
10	FR 1	1	.0780	.0720	.07525	.1025E-04
		2	.0780	.0730		
11	IT 1	1	.0900	.0890	.08938	.2292E-06
		2	.0890	.0895		
12	IT 2	1	.0885	.0890	.08850	.5000E-06
		2	.0890	.0875		
13	JP 1	1	.0842	.0832	.08335	.3567E-06
		2	.0832	.0828		
14	JP 2	1	.0898	.0890	.08975	.2767E-06
		2	.0900	.0902		
15	JP 3	1	.0871	.0860	.08688	.1149E-05
		2	.0883	.0861		
16	JP 4	1	.0846	.0858	.08520	.3000E-06
		2	.0849	.0855		
17	SE 1	1	.0849	.0880	.08623	.7669E-05
		2	.0830	.0890		
18	SU 1	1	.0880	.0881	.08778	.4292E-06
		2	.0868	.0882		
19	SU 3	1	.0945	.0905	.09145	.6803E-05
		2	.0924	.0884		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-7

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	41.077
CHI-SQUARE(.95,33)	47.407

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

FR 1	BOTTLE- 1	T-CALC = 4.036	T-CRIT(.00132,36) = 3.484
FR 1	BOTTLE- 2	T-CALC = 5.232	T-CRIT(.00135,35) = 3.483

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

BR 1	ZERO WITHIN-BOTTLE VARIANCE
CA 1	ZERO WITHIN-BOTTLE VARIANCE
FR 1	DOORNBOS' TEST FOR BOTTLE MEANS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-7

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	15	.21170484E-03	.14113656E-04
BETWEEN BOTTLES	16	.23962500E-04	.14976563E-05
WITHIN BOTTLES	32	.71715000E-04	.22410937E-05
TOTAL	63	.30738234E-03	

F-CALC = .668 F-CRIT(.95;16,32) = 1.972

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-7

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	40.38
CHI-SQUARE(.95,18)	28.877

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

NONE REJECTED

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

FR 1 R = .573 D-CRIT(19) = .501

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

FR 1 DIXON'S TEST FOR LABORATORY MEANS

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-7

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	17	.31248778E-03	.18381634E-04
WITHIN LABS	54	.11074500E-03	.20508333E-05
TOTAL	71	.42323278E-03	

REPEATABILITY VARIANCE	.20508333E-05
REPEATABILITY STD. DEV.	.00143207
BETWEEN-LABORATORIES VARIANCE	.40827002E-05
BETWEEN-LABORATORIES STD. DEV.	.00202057
REPEATABILITY	.00405277
PERMISSIBLE TOLERANCE BETWEEN LABS	.00639612
GRAND MEAN	.08738056
VARIANCE OF THE GRAND MEAN	.25530047E-06

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-4

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.4080	.4070	.40750	.3333E-06
		2	.4070	.4080		
2	AU 2	1	.4110	.4050	.40525	.2425E-04
		2	.4060	.3990		
3	AU 3	1	.4100	.4030	.40525	.2092E-04
		2	.4080	.4000		
4	AU 4	1	.4020	.4020	.40250	.1000E-05
		2	.4040	.4020		
5	BR 1	1	.4040	.4000	.40100	.1467E-04
		2	.4040	.3960		
6	BR 2	1	.4020	.3980	.40300	.1733E-04
		2	.4080	.4040		
7	BR 3	1	.3900	.3900	.39250	.8333E-05
		2	.3950	.3950		
8	CA 1	1	.3900	.3960	.39375	.2692E-04
		2	.4000	.3890		
9	CA 2	1	.4140	.4140	.41325	.2250E-05
		2	.4110	.4140		
10	FR 1	1	.3900	.3700	.38150	.1237E-03
		2	.3920	.3740		
11	IT 1	1	.4050	.3950	.40125	.2292E-04
		2	.4000	.4050		
12	IT 2	1	.4050	.3950	.39875	.5625E-04
		2	.4050	.3900		
13	JP 1	1	.3990	.3990	.39875	.2500E-06
		2	.3980	.3990		
14	JP 2	1	.4180	.4160	.41600	.2000E-05
		2	.4150	.4150		
15	JP 3	1	.3990	.4000	.39925	.2917E-05
		2	.3970	.4010		
16	JP 4	1	.3920	.4000	.39625	.1092E-04
		2	.3960	.3970		
17	SE 1	1	.4090	.4100	.40325	.6892E-04
		2	.3920	.4020		
18	SU 1	1	.4050	.4040	.40350	.1667E-05
		2	.4020	.4030		
19	SU 3	1	.3980	.3750	.39325	.3649E-03
		2	.4180	.3820		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-4

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	33.761
CHI-SQUARE(.95,27)	40.119

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

AU 4	ZERO WITHIN-BOTTLE VARIANCE
BR 3	ZERO WITHIN-BOTTLE VARIANCE
CA 2	ZERO WITHIN-BOTTLE VARIANCE
JP 1	ZERO WITHIN-BOTTLE VARIANCE
JP 2	ZERO WITHIN-BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-4

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	13	.23402321E-02	.18001786E-03
BETWEEN BOTTLES	14	.44325000E-03	.31660714E-04
WITHIN BOTTLES	28	.18265000E-02	.65232143E-04
TOTAL	55	.46099821E-02	

F-CALC = .485 F-CRIT(.95;14,28) = 2.064

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-4

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	75.378
CHI-SQUARE(.95,18)	28.877

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

SU 3	C-CALC = .474	C-CRIT(4,19) = .230
FR 1	C-CALC = .305	C-CRIT(4,18) = .240

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

FR 1	COCHRAN'S TEST FOR LABORATORY VARIANCE
SU 3	COCHRAN'S TEST FOR LABORATORY VARIANCE

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-4

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	16	.23909706E-02	.14943566E-03
WITHIN LABS	51	.84550000E-03	.16578431E-04
TOTAL	67	.32364706E-02	

REPEATABILITY VARIANCE	.16578431E-04
REPEATABILITY STD. DEV.	.00407166
BETWEEN-LABORATORIES VARIANCE	.33214308E-04
BETWEEN-LABORATORIES STD. DEV.	.00576319
REPEATABILITY	.01152280
PERMISSIBLE TOLERANCE BETWEEN LABS	.01823177
GRAND MEAN	.40241176
VARIANCE OF THE GRAND MEAN	.21975833E-05

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-12

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	.7910	.7910	.79425	.2225E-04
		2	.7940	.8010		
2	AU 2	1	.7600	.7660	.76875	.9825E-04
		2	.7660	.7830		
3	AU 3	1	.7520	.7670	.75675	.4825E-04
		2	.7550	.7530		
4	AU 4	1	.7800	.7500	.76425	.2722E-03
		2	.7770	.7500		
5	BR 1	1	.7750	.7750	.77500	.1667E-04
		2	.7700	.7800		
6	BR 2	1	.7860	.7820	.78000	.3467E-04
		2	.7800	.7720		
7	BR 3	1	.7540	.7620	.75750	.1167E-04
		2	.7580	.7560		
8	CA 1	1	.7510	.7650	.76550	.1367E-04
		2	.7700	.7660		
9	CA 2	1	.7650	.7650	.76500	.0000E+00
		2	.7650	.7650		
10	FR 1	1	.7460	.7300	.74100	.7867E-04
		2	.7500	.7380		
11	IT 1	1	.7900	.7800	.78625	.2292E-04
		2	.7850	.7900		
12	IT 2	1	.7900	.7800	.78375	.5625E-04
		2	.7750	.7900		
13	JP 1	1	.7840	.7770	.78000	.1267E-04
		2	.7820	.7770		
14	JP 2	1	.7970	.8000	.79700	.2467E-04
		2	.8010	.7900		
15	JP 3	1	.7750	.7740	.77625	.2092E-04
		2	.7830	.7730		
16	JP 4	1	.7790	.7690	.76300	.1787E-03
		2	.7510	.7530		
17	SE 1	1	.7660	.7940	.77250	.2723E-03
		2	.7550	.7750		
18	SU 1	1	.7710	.7730	.77125	.3892E-04
		2	.7780	.7630		
19	SU 3	1	.7700	.7670	.77400	.2953E-03
		2	.7990	.7600		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-12

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	30.399
CHI-SQUARE(.95,31)	44.991

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

AU 1	ZERO WITHIN-BOTTLE VARIANCE
BR 1	ZERO WITHIN-BOTTLE VARIANCE
CA 2	ZERO WITHIN-BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-12

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	15	.10807984E-01	.72053229E-03
BETWEEN BOTTLES	16	.11577500E-02	.72359375E-04
WITHIN BOTTLES	32	.32825000E-02	.10257812E-03
TOTAL	63	.15248234E-01	

F-CALC = .705 F-CRIT(.95;16,32) = 1.972

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-12

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	28.945
CHI-SQUARE(.95,17)	27.593

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

NONE REJECTED

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

ALL RESULTS WERE USED EXCEPT INDIVIDUAL REPLICATES LISTED BELOW

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 76-12

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	18	.13067632E-01	.72597953E-03
WITHIN LABS	57	.45570000E-02	.79947368E-04
TOTAL	75	.17624632E-01	

REPEATABILITY VARIANCE	.79947368E-04
REPEATABILITY STD. DEV.	.00894133
BETWEEN-LABORATORIES VARIANCE	.16150804E-03
BETWEEN-LABORATORIES STD. DEV.	.01270858
REPEATABILITY	.02530396
PERMISSIBLE TOLERANCE BETWEEN LABS	.04017023
GRAND MEAN	.77221053
VARIANCE OF THE GRAND MEAN	.95523623E-05

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-8

LABORATORY NO.	COUNTRY	BOTTLE NO.	ANALYTICAL RESULTS MANGANESE		LAB MEAN	LAB VARIANCE
1	AU 1	1	2.5840	2.5600	2.55600	.4540E-03
		2	2.5350	2.5450		
2	AU 2	1	2.5430	2.5910	2.55425	.1034E-02
		2	2.5160	2.5670		
3	AU 3	1	2.5260	2.4630	2.49925	.7722E-03
		2	2.5150	2.4930		
4	AU 4	1	2.5600	2.5200	2.55000	.1467E-02
		2	2.6000	2.5200		
5	BR 1	1	2.4700	2.5100	2.49000	.3333E-03
		2	2.5000	2.4800		
6	BR 2	1	2.5310	2.5140	2.51575	.2589E-03
		2	2.5240	2.4940		
7	BR 3	1	2.5100	2.5210	2.51100	.7533E-04
		2	2.5000	2.5130		
8	CA 1	1	2.5010	2.4990	2.49925	.4958E-04
		2	2.5070	2.4900		
9	CA 2	1	2.5230	2.5200	2.51800	.4600E-04
		2	2.5210	2.5080		
10	FR 1	1	2.5300	2.5800	2.55750	.2092E-02
		2	2.5100	2.6100		
11	IT 1	1	2.5200	2.5200	2.52250	.2500E-04
		2	2.5300	2.5200		
12	IT 2	1	2.5350	2.5250	2.52625	.5396E-03
		2	2.5500	2.4950		
13	JP 1	1	2.5230	2.5230	2.52750	.4367E-04
		2	2.5270	2.5370		
14	JP 2	1	2.6020	2.6020	2.59950	.2500E-04
		2	2.5920	2.6020		
15	JP 3	1	2.4880	2.4950	2.49275	.6425E-04
		2	2.5030	2.4850		
16	JP 4	1	2.5280	2.5160	2.52425	.3225E-04
		2	2.5280	2.5250		
17	SE 1	1	2.5710	2.3800	2.46700	.6757E-02
		2	2.4290	2.4880		
18	SU 1	1	2.5200	2.5110	2.51200	.5000E-04
		2	2.5140	2.5030		
19	SU 3	1	2.4830	2.3510	2.42525	.4763E-02
		2	2.4850	2.3820		

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-8

BARTLETT'S TEST FOR HOMOGENEITY OF BOTTLE VARIANCE

CALCULATED STATISTIC	43.739
CHI-SQUARE(.95,31)	44.991

VARIANCE IS HOMOGENEOUS
(COCHRAN'S TEST NOT PERFORMED)

DOORNBOS' TEST FOR BOTTLE MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR TWO-WAY ANOVA

IT 1	ZERO WITHIN-BOTTLE VARIANCE
JP 1	ZERO WITHIN-BOTTLE VARIANCE
JP 2	ZERO WITHIN-BOTTLE VARIANCE

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-8

TWO-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	15	.73468438E-01	.48978958E-02
BETWEEN BOTTLES	16	.31970000E-02	.19981250E-03
WITHIN BOTTLES	32	.53166000E-01	.16614375E-02
TOTAL	63	.12983144E+00	

F-CALC = .120 F-CRIT(.95;16,32) = 1.972

TEST SAMPLE IS HOMOGENEOUS

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-8

BARTLETT'S TEST FOR HOMOGENEITY OF LABORATORY VARIANCE

CALCULATED STATISTIC	74.460
CHI-SQUARE(.95,18)	28.877

VARIANCE IS INHOMOGENEOUS

COCHRAN'S TEST FOR LABORATORY VARIANCE (ALPHA=.05)

SE 1	C-CALC = .358	C-CRIT(4,19) = .230
SU 3	C-CALC = .393	C-CRIT(4,18) = .240
FR 1	C-CALC = .284	C-CRIT(4,17) = .250
AU 4	C-CALC = .278	C-CRIT(4,16) = .262

DIXON'S TEST FOR LABORATORY MEANS (ALPHA=.05)

NONE REJECTED

LIST OF LABORATORIES WHOSE RESULTS WERE NOT USED FOR ONE-WAY ANOVA

AU 4	COCHRAN'S TEST FOR LABORATORY VARIANCE
FR 1	COCHRAN'S TEST FOR LABORATORY VARIANCE
SE 1	COCHRAN'S TEST FOR LABORATORY VARIANCE
SU 3	COCHRAN'S TEST FOR LABORATORY VARIANCE

LIST OF INDIVIDUAL OUTLIERS DETECTED BY DIXON'S TEST WITHIN-LABORATORIES

NONE REJECTED

ISO/TC 102/SC 2/WG 26B - MANGANESE BY AAS METHOD - FUSION DISSOLUTION
SAMPLE: 83-8

ONE-WAY ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	D.F.	SUM OF SQUARES	MEAN SQUARE
BETWEEN LABS	14	.45697933E-01	.32641381E-02
WITHIN LABS	45	.11410250E-01	.25356111E-03
TOTAL	59	.57108183E-01	

REPEATABILITY VARIANCE	.25356111E-03
REPEATABILITY STD. DEV.	.01592360
BETWEEN-LABORATORIES VARIANCE	.75264425E-03
BETWEEN-LABORATORIES STD. DEV.	.02743436
REPEATABILITY	.04506379
PERMISSIBLE TOLERANCE BETWEEN LABS	.08392393
GRAND MEAN	2.52321667
VARIANCE OF THE GRAND MEAN	.54402302E-04